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Volcanoes triggered by dynamic and static stress changes in Chile: Observations, stress field changes and physical modelling

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Evidence is increasing that subduction zone earthquakes may influence the volcanic activity along a volcanic arc. The processes of triggering, however, are not clear. In a commonly discussed concept, changes of the crustal stress field may affect intrusive bodies under volcano, open magma pathways and faults, and decompress a magma-fluid system. Other concepts focus on the dynamic passage of seismic waves, inducing bubble growth and ascent as well as fluid migration.
Volcanoes in the south and central Andes have a century long documented history of earthquake - eruption interactions. Numerous subduction earthquakes were followed by more and unexpected volcano eruptions, which is why we here concentrate our research on this particular area. The most recent major subduction earthquake occurred on April 1st, 2014, close to the coast of northern Chile. During this event we had volcano monitoring stations located at several active volcanoes and fumarole sites, as well as at on of the largest geyser fields of the world, all located within 500 km distance to the earthquake epicenter. Here we present preliminary results describing if and how those monitored volcano sites showed activity level changes, which is an opportunity to study the influence of earthquakes over active and dormant volcanoes. After analysis of the date we computed the static strain and stress field in the overriding plate and at the sites of the volcanoes. In addition we design physical models that allow to study not only the effects of static stress changes and dilatation on fluid paths, but also the effect of dynamic processes. To this aim we simulate real seismic waveforms on a shaking table hosting an analogue volcano, and discuss under which situations magma paths and ascent rates are augmented and hindered by the subduction earthquake. Results are transferrable to other subduction related volcano-earthquake interactions and may allow better understanding of the processes of static and dynamic triggering.